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Date Palm Revisited.

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ABSTRACT

The date palm (*Phoenix dactylifera*) has been known and used for medicinal purposes since ancient times. In this article, we shall review the pharmaceutical benefits of dates. The numerous uses and applications of the various parts of the date plant are described in detail. Emerging uses such as applications in cardiology are mentioned briefly. We shall cover the date fruit in the Islamic tradition.

Keywords: Date, Date Palm, *Phoenix dactylifera* Linn., Date Palm, uses and applications, Phytochemistry, dates in Islamic tradition.

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INTRODUCTION

The history of date-palm cultivation can be traced to eight thousand years. Every part of the date-palm has good use: The wood and leaves provide timber and fabric for houses and fences; the leaves are also used for making ropes, baskets etc; the stalk is used as fuel. The fruits famous for their delicious and sweet taste are taken directly or processed to produce vinegar, pickle, bakery items and flavours. The date seeds are used as cattle feed after they have been softened by soaking and crushing. The date-palms are usually unbranched. It is interesting to note that the branching occurs only in the male plants! There are typically a dozen bunches of dates per tree. A bunch weighs about seven kilograms and has a thousand dates (See Figure-1 and Figure-2). The life of a date tree is over hundred and fifty years. There are about a thousand varieties of dates. Some of these are facing possible extinction. The date fruits vary in size, shape and colour. Each of these numerous varieties have different name in Arabic. According to the estimates of the World Food Agricultural Organization, there are over hundred million date-palms in the world, producing two million tons of dates each year. About 65% of these are grown in the Arab countries. Let us have a closer look at this familiar fruit, which is also known as the *tree of life* and *king of the oasis*. The botanical name of the date-palm is *Phoenix dactylifera* Linn. In Arabic the date-palm is known as *Nakhl*, and the fruit is known as *Tamar*. We shall note the names in several other languages: *Tamar* (Hebrew), *Khajur* (Hindi, Urdu, and several Indian languages), *Khurma* (Persian, Urdu), *Kharjur* (Sanskrit), *Khejur* (Bengali), *Finik* (Russian), *Datil* (Spanish), *Date* (Italian), *Datteir* (French), *Daten* (German), *Datum* (Dutch), *Datas* (Portugese) and so on.



Figure 1: The Dates and its Seeds



Figure 2: The Date Palm

In the article, we shall outline the taxonomy, phytochemistry and the medicinal benefits of date fruits and the products derived from the date palm.

Taxonomy:

Date palm (*Phoenix dactylifera* Linn.) is a diploid, perennial, and monocotyledonous plant belonging to *Palmaceae*. The name of date palm originates from its fruit; *phoenix* from the Greek means purple or red (fruit), and *dactylifera* refers to the finger-like appearance of the fruit bunch. Date trees grow up to 30m in

height, with an average diameter of less than 50cm. The species has a characteristic clustered trunk which is covered with petiole scars, and a loose crown of 20-30 leaves, which is scarred by old leaf bases. Suckers may appear after 6-16 years, but are often removed. The stem and new leaves grow from the single terminal bud at the stem apex. The roots grow from the base of the trunk, sometimes 50cm above the ground. The main roots are about 1.5cm thick. The leaves are pinnate, up to 7m long, with rigid rachis and spiny petiole 20-100cm long. The upper leaves are ascending and basal ones are curved. The 50-60 long and narrow pairs of leaflets are attached to a stout central midrib or rachis. The leaves have a normal life of 3-7 years. The leaves are glaucous green, acute, covered by a powdery wax. Mature palms have over 100 leaves, producing 1-2 new leaves per month. About 100-200 leaflets are found on each leaf, up to one metre long and 1cm to 7cm wide, folded longitudinally, with entire margins.

Date palm is dioecious, meaning it has separate female and male trees. Whether staminate or pistillate, flowers are borne on a compound spadix in leaf axils, having 50-150 lateral branches. A dozen or more inflorescences are produced annually, more in males than females. Inflorescences are sheathed in a bract or spathe until just prior to anthesis. Each sex produces thousands of tiny flowers per inflorescence. Male flowers are white, fragrant, about 1cm to 3cm wide, with 6 stamens each, and females are more yellowish or cream colored, smaller (about 1cm), with trilobular superior ovaries and a 3-lobed stigma. Dates are wind or insect pollinated naturally, and natural pollination can be practiced in seedling orchards with 1:1 ratios of males to females. In most commercial orchards, however, only one male is grown for every 50 females, and pollination is accomplished artificially [1].

The fruit of *Phoenix dactylifera* is a drupe known as a date. Dates are large with a thick layer of fruit pulp, edible, very sweet, and rich in sugars; the other species in *Phoenix* have only a thin layer of fruit pulp. They are oval or cylindrical, 3-7cm long and 2-3cm in diameter. Each date contains a single seed about 2-3cm and 6-8mm in thickness. The skin is thin and papery. When unripe, they are green, and change to yellow, golden brown, mahogany red, or black as they ripen, depending on the variety.

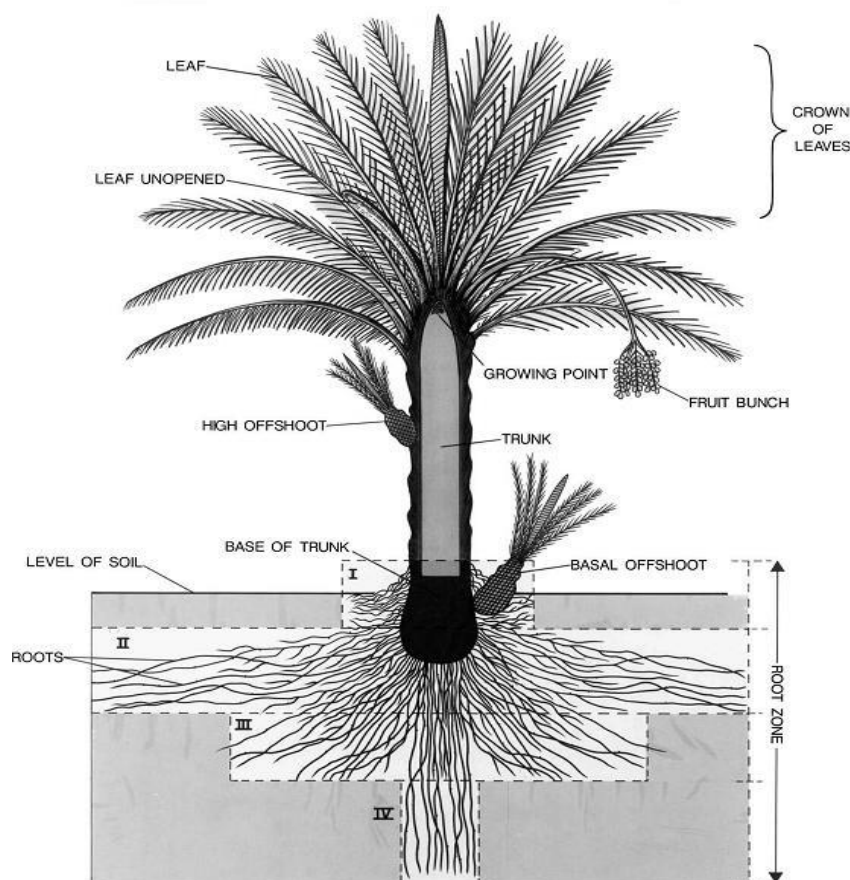


Figure 3: The Schematic Diagram of the Date Palm

The branching is very rare in the date-palm trees (see Figure-4). The famous *Imperial Palm* having eight branches is located in the botanical garden, *Huerto del Cura*, Elche, Alicante province, Spain (see Figure-4-a). It is estimated to be about 165 years old and weighs ten tons. The largest triple-trunk Medjool date palm ever transplanted and installed is in Houston, Texas, USA (Figure-4-b). The University of Arizona Campus Arboretum has a very old branched date palm tree (Figure-4-c). Then, there is the branched date palm in California, USA (Figure-4-d).



Figure 4: Branched Date Palm Trees

Cultivars of dates:

Three main cultivar groups of dates exist; *soft* (examples: *Barhee*, *Halawy*, *Khadrawy*, *Medjool*), *semi-dry* (examples: *Dayri*, *Deglet Noor*, *Zahidi*), and *dry* (example: *Thoory*). The type of fruit depends on the glucose, fructose, and sucrose content. In soft dates, about 80 percent of the dry matter is invert sugars (mixture of equal parts of glucose and fructose), while in semi-dry dates, about 40 percent of the dry matter is invert sugars and forty percent is sucrose. In dry dates, about 20 to 40 percent of the dry matter is invert sugars, and

40 to 60 is sucrose [2]. A very large number of date cultivars are grown. The most important varieties with their translated names in parenthesis include:

1. Aabel—common in Libya
2. Ajwah—from the town of Ajwah in Saudi Arabia.
3. Amir Hajj or Amer Hajj (*visitors' date*)—from Iraq.
4. Abid Rahim—from Sudan.
5. Barakawi—from Sudan.
6. Barhee.
7. Bireir—from Sudan.
8. Deglet Noor (*Translucent or date of light*).
9. Derrie or Dayri (*Monastery date*)—from Southern Iraq.
10. Empress—from California USA.
11. Ftimi or Alligue—from Tunisia.
12. Halawy or Halawi (*Sweet*).
13. Haleema—from Hoon, Libya.
14. Hayany—from Egypt.
15. Iteema—common in Algeria.
16. Kajur—common in Pakistan/India.
17. Kenta—common in Tunisia.
18. Khadrawi or Khadrawy (*Green*).
19. Khalasah (*Quintessence*)—Eastern Province of Saudi Arabia.
20. Khastawi or Khusatawi/Kustawy—from Iraq.
21. Maktoom (*hidden*).
22. Manakbir.
23. Medjool (*Unknown*)—mostly from Morocco (also in USA, Jordan and Israel).
24. Migraf or Mejraf—from Southern Yemen.
25. Mgmaget Ayuob—from Libya.
26. Mishriq (*East*)—from Sudan and Saudi Arabia.
27. Nabtat-seyf—from Saudi Arabia.
28. Sag'ai—from Saudi Arabia.
29. Saily or Saidi—from Libya.
30. Sayer or Sayir (*Common*).
31. Sekkeri (*sugary*)—from Saudi Arabia.
32. Sellaj—in Saudi Arabia.
33. Tagyat—common in Libya.
34. Tamej—in Libya.
35. Thoory or Thuri—from Algeria.
36. Umeljwary—from Libya.
37. Umelkhashab—from Saudi Arabia.
38. Zahidi (*ascetic*).

There are more than 100 known cultivars in Iraq alone. It should be noted, however, that the same cultivar may have several names depending on the locality. Date Palms are susceptible to a disease called *Bayoud* disease, which is caused by the fungus *Fusarium oxysporum*. This disease, which kills many of the popular older cultivars like *Deglet Noor* has led to a major decline in production, where it is present, notably Morocco and western Algeria. However, new cultivars resistant to the disease are being developed.

Phytochemistry:

Dates are very delicious and easy to store as they are light. Date is one of the most valuable foodstuffs. Date consumption is one of important sources of supplying minerals and vitamins and elements in a very balance nutrition regime. About 70% of the fruit is sugar. Dates are excellent sources of numerous minerals including: iron, potassium, magnesium, sulphur, copper, calcium and phosphorus. Besides it has several vitamins, fibre and proteins [3]. A hundred grams of dates provide the body about 277 kilo-calories shortly after eating it. An individual needs about 2500-3500 kilo-calories (traditionally, one loosely says

calories omitting the kilo!) per day [2]. This is the medical explanation why the dates are consumed at the end of fasting by the Muslims around the world (Figure-5).

Dates (variety: medjool) Nutritive Value per 100 grams		
Source: United States Department of Agriculture (USDA) National Nutrient Data Base, http://www.ars.usda.gov/nutrientdata		
Principle	Nutrient Value	Percentage of RDA
Energy	277 Kcal	14%
Carbohydrates	74.97 g	58%
Protein	1.81g	3%
Total Fat	0.15 g	<1%
Cholesterol	0 mg	0%
Dietary Fiber	6.7 g	18%
VITAMINS		
Folates	15 µg	4%
Niacin	1.610 mg	10%
Pantothenic acid	0.805 mg	16%
Pyridoxine	0.249 mg	19%
Riboflavin	0.060 mg	4.5%
Thiamin	0.050 mg	4%
Vitamin A	149 IU	5%
Vitamin C	0 mg	0%
Vitamin K	2.7 µg	2%
ELECTROLYTES		
Sodium	1 mg	0%
Potassium	696 mg	16%
MINERALS		
Calcium	64 mg	6.5%
Copper	0.362 mg	40%
Iron	0.90 mg	11%
Magnesium	54 mg	13%
Manganese	0.296 mg	13%
Phosphorus	62 mg	9%
Zinc	0.44 mg	4%
PHYTO-NUTRIENTS		
Carotene-β	89 µg	--
Crypto-xanthin-β	0 µg	--
Lutein-zeaxanthin	23 µg	--
RDA: Reference Daily Intake or Recommended Daily Intake, which is considered sufficient to meet the dietary requirements of most individuals.		

Comparison of date calorie with other foodstuffs per 450 GRS

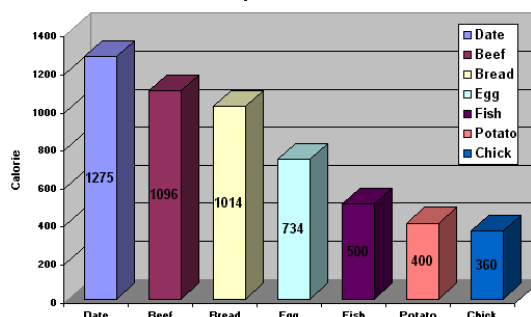


Figure 5: Dates and Calories

Because of its rich chemical content, the dates have been used as a medicine since ancient times. The tradition among the Arabs and the Muslims to place chewed (to soften) dates in the mouth of new born babies, carries great virtue and benefit. Date is effective in treatment of infantile paralysis and it is

recommended to give some grains of date to children suffering infantile paralysis. Dates strengthen the nervous system. Because of the magnesium present in them the dates are good for the kidneys. Dates are also helpful in treating sore throat and all the pulmonary infections. Persons suffering diabetes can use dates instead of industrial sugars like cane sugar, since the existing magnesium within dates help the operation of pancreas and kidneys on the other hand vitamin B2 within dates absorbs sugar components of other foodstuffs. Dates are also good for heart and respiratory problems [4-5]. The dates have a significant role in disease prevention via anti-oxidant, anti-microbial and anti-inflammatory activity (Figure-6).

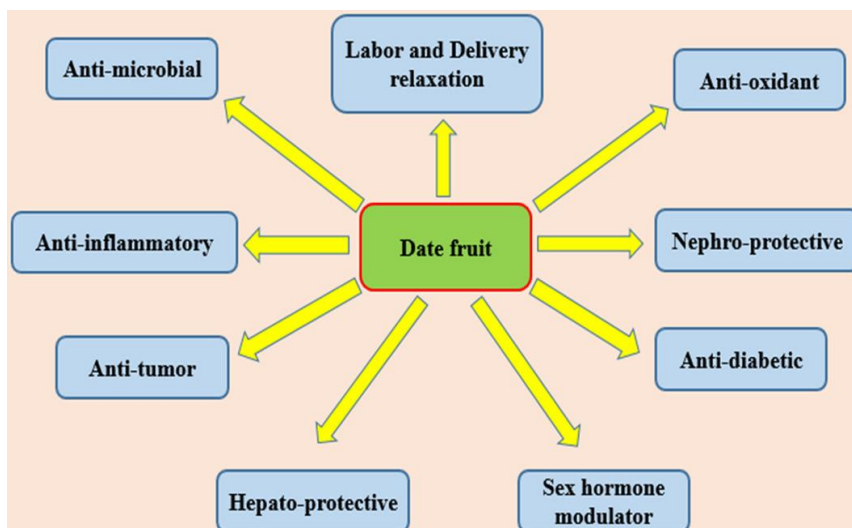


Figure-6: Pharmacological activities of dates fruits in diseases control.

Uses of Date Palm:

The complete tree of date palm has numerous uses including:

1. **Food:** The most important use of the date palm is for its fruit, which forms the staple diet of many people in Africa and the Middle East and is as well a cash crop for export. The seeds are roasted and kernels ground as a coffee substitute. Terminal bud leaves are eaten as a vegetable. The sap can be boiled into unrefined sugar.
2. **Fodder:** The seeds (stones) when ground and softened by soaking in water are used for feeding camels, goats and horses and have successfully been substituted as a possible poultry feed.
3. **Fuel:** The wood can be used as fuel-wood.
4. **Fibre:** The leaves are used in mats, ropes, fans and baskets; the petiole yields a fibre, which together with other suitable material is used for insulating boards.
5. **Timber:** The trunks are strong and resistant to termites, providing much valued construction timber.
6. **Medicine:** Dates are a demulcent, an expectorant and a laxative, and are used to treat respiratory diseases and fever. The tree yields a gum used in treating diarrhea.
7. **Erosion control:** The leaves are applied in sand dune stabilization.
8. **Shade and Shelter:** Old leaves of the date palm are used for thatching.
9. **Reclamation:** Being a halophytic species, date palm has been used for decades for the revegetation of salt affected lands in the Mediterranean region.
10. **Boundary or Barrier or Support:** Dried leaves with their stiff, woody rachis are used for fencing.
11. **Soil Improver:** Prunings of leaves are used as manure.
12. **Ornamental:** The genus Phoenix is one of the most widely cultivated groups of palms, its species being extensively used for bold landscape planting, as individual specimens, for avenue planting, and to a lesser extent, as potted plants.
13. **Intercropping:** Phoenix dactylifera while young occupies a lot of space, so a decision to introduce it into cultivated fields must be taken carefully. But once mature, its wide crown grows high above the field crops, and it little affects the yield of cultivated crops. In many places, numerous palms are found in arable fields of suitable regions.

Date seeds are soaked (for softening) and ground and used as an excellent animal feed. Their oil is suitable for use in soap and cosmetics. Date palm seeds contain 0.56–5.4% lauric acid (useful in chemical analysis, particularly for finding the molar masses). They can also be processed chemically as a source of oxalic acid (used in dyeing processes and bleaches). The seeds are also burned to make charcoal for silversmiths, and can be strung in necklaces. Date seeds are also ground and used in the manner of coffee beans, or as an additive to coffee. Experimental studies have shown that date seeds exhibit anti-genotoxic and reduce DNA damage caused by certain chemicals.

Dates in the Islamic Tradition:

The Muslims world-wide have the tradition to end the *Siyaam* (fast or fasting) by taking date fruits. This is based on the saying of the Prophet Mohammad (peace and blessings be upon him), “*break your Siyaam by eating dates as it is purifying*”. About twenty fruits and fruit bearing plants have been identified in the Holy Quran, but it is the date-palm which is referred the most [6-7]. It is mentioned twenty times, in eight places individually and in twelve places with other fruits. The twenty plants mentioned in the Holy Quran include: date palm, fig, ginger, grape, garlic, henna/camphor, lentil, manna, olive, onion, pomegranate, summer squash, sweet basil, athel tamarisk, tooth-brush tree, arak, mustard, acacia, cucumber, gourd, leek, cedrus (cedar or Lote-tree) and Euphorbia [6-7]. The *Bitter Thorn* and *Blessed Tree* are yet to be identified. The Bitter Thorn is the tree in the Jahannum (hell) and is mentioned in Surah Al-Ghashiyah (88, meaning The Overwhelming Event): 6-7. The Blessed Tree is mentioned in Surah Al-Ra`d (13, meaning The Thunder): 29. The Quranic botany continues to be an active area of research. The date palm is mentioned by name twenty times, in eight places individually and in twelve places with other fruits. The corresponding twenty Ayah occurring in sixteen Surah of the Holy Quran are: Al-Baqarah (2): 266; Al-An`am (6): 99, 141; Al-Ra`d (13): 4; Al-Nahl (16): 11, 67; Al-Isra (17): 91; Al-Kahf (18): 32; Maryam (19): 23, 25; Ta Ha (20): 71; Al-Mu`minun (23): 19; Al-Shu`ara' (26): 148; Ya Sin (36): 34; Qaf (50): 10; Al-Qamar (54): 20; Al-Rahman (55): 11, 68; Al-Haqqah (69):7; and `Abasa (80): 29 respectively [8-9]. Throughout the holy month of Ramadan-ul-Mubarak, dates are a common ingredient in the Muslim diet.

As stated in the Hadeeth (saying), the Holy Prophet (peace be upon him) said, “Whoever eats seven *ajwah* dates in the morning will not be harmed by poison or black magic for the rest of that day until the night.” The Prophet (peace be upon him) also said, “The *ajwah* date is from Paradise and it is an antidote against poison.” The *ajwa* variety of dates is very effective in combating cardiovascular problems [3]. Nutritious, health, medical and industrial value of the date is not fully recognized. The researchers all over the world is searching and investigating in the matter.

Dates are excellent choice of food for the pregnant women and those who have just given birth. This fact is indicated in the famous and the very beautiful passage of the Holy Quran

فَأَجَاءَهَا الْمَخَاضُ إِلَى جِذْعِ النَّخْلَةِ قَالَتْ يَا لَيْتَنِي مِتُّ قَبْلَ هَذَا وَكُنْتُ
نَسِيًّا مَنْسِيًّا
(19:23)

فَنَادَاهَا مِن تَحْتِهَا أَلَا تَحْزَنِي قَدْ جَعَلَ رَبُّكِ تَحْتَكِ سَرِيًّا
(19:24)

وَهُزِّي إِلَيْكِ بِجِذْعِ النَّخْلَةِ تُسَاقِطُ عَلَيْكَ رَطْبًا جَنِيًّا
(19:25)

(Surah 19, Maryam, Ayah 23-25)

And [when] the throes of childbirth drove her to the trunk of a palm-tree, she exclaimed: “Oh would that I had died ere this, and had become a thing forgotten, utterly forgotten!” Thereupon [a voice] called out to her from beneath that [palm-tree]. Grieve not! Thy Sustainer has provided a rivulet [running] beneath thee; and shake the trunk of the palm-tree towards thee: it will drop fresh, ripe dates upon thee.

(English Meaning by Muhammad Asad from <http://www.IslamiCity.com/>)

This was the prescription given to Virgin Mary at the time of birth of Jesus, the blessed Prophet of Allah. It was a prescription to make the delivery easy and comfortable.

In recent decades, the plants mentioned in the Holy Quran and the Hadith (Prophetic Traditions) have acquired a special interest of the gardeners, botanists and the scientists in general. This has led to the creation of special gardens which are commonly known as the “Quranic Botanical Gardens”, serving as exhibitions and dedicated research centres. The UNESCO (United Nations Educational, Scientific and Cultural Organization) is also taking an interest in such gardens and has set up one in Qatar. A unique biological garden featuring the plants mentioned in the Holy Quran has been created in the Education City, Doha (capital of Qatar). Known as the “Quranic Botanic Garden”, it is under the umbrella of the global Qatar Foundation Green Project [10]. This Quranic Botanical Garden comprises of all the plant species mentioned in the Holy Quran, and those in Sunnah (Deeds of the Prophet) and Hadith (Sayings of the Prophet). It also exhibits botanical terms mentioned in the Holy Quran, explaining them in the context of modern science. It regularly holds conferences and other events.

It is high time to cultivate some Quranic/Prophetic plants in and around Muslim institutions such as Masajid (mosques); Madaris (Islamic Seminaries/Schools); Eid-Gah Grounds (grounds dedicated for Eid Salaat/Prayers and other Gatherings); Qabrastan (Graveyards); among others. The government ministries and state forest officials should be introduced to the importance and the need for cultivating the Quranic/Prophetic plants. Such initiatives will benefit the complete region in more than one way. After all, the plants have medicinal use and a commercial value through local markets and exports.

Concluding Remarks:

The research on date-palms is an active field establishing old sayings and leading to numerous new discoveries. An old Arab saying goes: “the uses of date-palm are as many as the number of days in the year”. With all the rapid advances more and more nutritional values of dates are being understood [11-16]. The other traditional plants with plenty of uses include the olives [17-20]. As the honeybees derive the honey from the nectar of flowers, the honey can be counted among the plant products [21-22]. We shall return to these in other articles.

BIBLIOGRAPHY

- [1] ChihCheng T. Chao and Robert R. Krueger, The Date Palm (*Phoenix dactylifera* L.): Overview of Biology, Uses, and Cultivation, *HortScience*, 2007, 42 (5) 1077-1082. <http://hortsci.ashspublications.org/content/42/5/1077.full.pdf>
- [2] D.A. Bender and A. E. Bender. 2005. *A Dictionary of Food and Nutrition*, New York: Oxford University Press. <http://isbn.nu/9780198609612>
- [3] Tauqeer Hussain Mallhi, Muhammad Imran Qadir, Muhammad Ali, Bashir Ahmad, Yusra Habib Khan and Atta-Ur-Rehman¹, Ajwa Date (*Phoenix dactylifera*): An Emerging Plant in Pharmacological Research, *Pakistan Journal of Pharmaceutical Sciences*, 2014, 27 (3) 607-616. <http://www.pjps.pk/wp-content/uploads/pdfs/27/3/Paper-30.pdf>
- [4] Arshad H Rahmani, Salah M Aly, Habeeb Ali, Ali Y. Babiker, Sauda Srikar and Amjad A Khan, Therapeutic effects of date fruits (*Phoenix dactylifera*) in the prevention of diseases via modulation of anti-inflammatory, anti-oxidant and anti-tumour activity, *International Journal of Clinical and Experimental Medicine (IJCEM)*, 2014, 7 (3):483-91. <http://www.ijcem.com/files/ijcem1401053.pdf>
- [5] Abiola M. Adeosun, Sarah O. Oni, Osasenaga M. Ighodaro, Okikiola H. Durosinlorun, and Omotayo M. Oyedele, Phytochemical, minerals and free radical scavenging profiles of *Phoenix dactylifera* L. seed extract, *Journal of Taibah University Medical Sciences*, 2016, 11 (1) 1–6. <http://dx.doi.org/10.1016/j.jtumed.2015.11.006>
- [6] Mohammed Iqtedar Husain Farooqi, *Plants of the Qur’an*, Sidrah Publishers, Lucknow, India (2003).
- [7] Mohammed Iqtedar Husain Farooqi, *Medicinal Plants in the Traditions of the Prophet Muhammad: Scientific Study of the Prophetic Medicine, Food and Perfumes (Aromatics)*, Sidrah Publishers, Lucknow, India (2004).
- [8] A website for Quran Majeed with comprehensive search in Arabic and numerous languages, along with several English translations (meanings), <http://www.islamicity.com/mosque/quran/>
- [9] Websites for *Hadith*, <http://www.searchtruth.com/> and <http://ahadith.co.uk/>
- [10] Qur’anic Botanic Garden, Doha, Qatar, <http://www.qf.org.qa/explore/heritage-centers/quranic-botanic-garden>



- [11] Sameen Ahmed Khan, A Date with Dates, *Youth Observer*, 2005, pp. 4, Supplement to *Oman Observer*, 2005, 24, No. 328.
- [12] Sameen Ahmed Khan, A Date with Tradition, *Radiance Viewsweekly*, 2006, XLIV, No. 17, 28-29.
- [13] Hajira Khan and Sameen Ahmed Khan, Dates Round the Year, *BaKhabar*, 2014, 7 (7), 18-20. <http://bakhabar.biharanjuman.org/>.
- [14] Hajira Khan and Sameen Ahmed Khan, Dates for Health, *Radiance Viewsweekly*, 2014, LII, No. 14, 23-27.
- [15] Hajira Khan and Sameen Ahmed Khan, Joy of Dates, *Tameer-e-Fikr*, 2015, 3 (3), 22-24.
- [16] Sameen Ahmed Khan, What is Chemistry?, *Radiance Viewsweekly*, 2015, LIII, No. 23, 24-25.
- [17] Sameen Ahmed Khan, Olive the Blessed Tree, *Radiance Viewsweekly*, 2006, XLIV, No. 18, 22-23.
- [18] Sameen Ahmed Khan, Olive the Blessed Tree, *Youth Observer*, 2006, pp. 12, Supplement to *Oman Observer*, 2006, 25, No. 355.
- [19] Sameen Ahmed Khan, Zeroing on Olives, *BaKhabar*, 2015, 8 (6), 19-21. <http://bakhabar.biharanjuman.org/>.
- [20] Hajira Khan and Sameen Ahmed Khan, Blessed Tree of Olive, *Asian Journal of Pharmaceutical and Clinical Research (AJPCR)*, 9 (3). <http://ajpcr.com/> and <http://innovareacademics.in/journals/index.php/ajpcr/issue/archive>.
- [21] Devasvaran K, Yong YK, Anti-inflammatory and wound healing properties of Malaysia Tualang honey, *Current Science*, 2016, 1, 47-51.
- [22] Hajira Khan and Sameen Ahmed Khan. Better Health with Honey, *Radiance Viewsweekly*, 2016, LIV, No. 1.